Monitoring Study Group
Monitoring Program

STRATEGIC PLAN

California State Board of Forestry
and Fire Protection

California Department of Forestry
and Fire Protection

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MISSION / VISION

The Monitoring Study Group's (MSG's) monitoring program will provide timely information on the implementation and effectiveness of forest practices related to water quality that can be used by forest managers, agencies, and the public in California.

DESCRIPTION OF MONITORING PROGRAM

Since 1990, CDF has funded a program designed to ascertain if forest practice rules protecting beneficial uses of water are being implemented and are effective. A Board of Forestry and Fire Protection (BOF) committee named the Monitoring Study Group (MSG) oversees the program. From 1989 to 1999, the MSG was an "ad hoc" committee which met periodically to (1) develop and implement the long-term program testing the effectiveness of the rules and (2) provide guidance to CDF in implementing the program. At the July 1999 BOF meeting, the BOF agreed that it was appropriate to upgrade the MSG to a standing Board committee. The primary reasons for upgrading the MSG to a standing committee are:

1) monitoring forest practices related to water quality is a long-term program which requires input from a broad-based steering committee;

2) frequent briefings are critical because information about the adequacy of the existing and potential new rules related to water quality is of the utmost importance to the BOF; and

3) a standing committee of the BOF would generate greater acceptance of the program and its monitoring results—since there will be a higher likelihood that all or most of the agencies and organizations will have been involved throughout the process (not just those with a current interest in the committee).

The MSG is made up of members of the public, resource agencies, and the timber industry. Each agency and organization is responsible for determining the appropriate person to serve as a representative on the MSG (i.e., the BOF will not make formal appointments to the MSG). All relevant organizations are invited to attend the meetings and these gatherings can be described as an open public forum to discuss monitoring issues.

The MSG is chaired by a BOF member and staffed by CDF. Funding for administering the monitoring program is from the State's General Fund. In addition, CDF has $250,000 per year available for interagency agreements and contracts with private companies. Appendix A lists contracts and products from contracts or interagency agreements for budget years 1991 through 1998. Appendix B provides a list of monitoring reports produced during this same period.

INTERNAL AND EXTERNAL ASSESSMENT

The monitoring of forestry practices in California has historically related to protection of water quality. Many of the rules developed by the Board of Forestry after passage of the Forest Practice Act in 1973 are focused on water quality protection. In 1983, the Board passed watercourse protection rules specifying mitigation measures keyed to the beneficial uses of water. The State Water Resources Control Board (SWRCB) conditionally certified the Forest Practice Rules and review process as meeting Best Management Practices standards for Section 208 of the Federal Clean Water Act in 1984.

As a condition of Water Board certification, a monitoring and assessment program was required to be implemented. Due to funding constraints, a one-year qualitative assessment of forest practices was undertaken in 1986 by a team of four resource professionals (Johnson 1993). This effort included review of 100

Timber Harvesting Plans completed over the entire state and completion of the "208 Report," which found that the rules generally were effective when properly implemented on terrain that was not highly sensitive.

In 1988, the Board of Forestry (BOF), CDF, and the SWRCB entered into a Management Agency Agreement (MAA) that required the BOF to improve forest practice regulations for better protection of water quality, largely based on needs described in the "208 Report." At this point, the SWRCB approved certification. EPA, however, withheld certification until the conditions of the MAA were satisfied, one of which was to develop a long-term monitoring program. The Monitoring Study Group was created to develop this program.

ACCOMPLISHMENTS

From the start, the MSG agreed that monitoring information had to be both scientifically credible and relevant to foresters, agencies and the public. In 1990, a volunteer panel appointed by the BOF known as the Best Management Practices Effectiveness Assessment Committee (BEAC) held public outreach meetings throughout the state, where the public stated that protection of cold water fish habitat and domestic water supplies were critical, and that the monitoring program being developed must be able to detect changes in these beneficial uses resulting from timber operations (BOF 1991). Based on this public input, the MSG required that the program include both implementation and effectiveness monitoring. It also set forth a design strategy that used pilot projects to develop appropriate techniques for both instream and hillslope monitoring. Accomplishments of the program to date follow:

- The Pilot Monitoring Program conducted during 1993 and 1994 by CDF, DFG, CDMG, and SWRCB staff to design and test procedures for implementation and effectiveness monitoring, including:

1. State Department of Fish and Game (DFG) instream monitoring pilot work. As part of the project, DFG documented the training and quality control needs and the range in variability for several instream monitoring parameters (Rae 1995).

2. Forms to record hillslope monitoring observations. Dr. Andrea Tuttle and CDF modified U.S. Forest Service forms and created new forms and procedures to record detailed information applicable to locations within Timber Harvesting Plans (THPs) that were identified as presenting the greatest risk to water quality—roads, skid trails, landings, watercourse crossings, and watercourse and lake protection zones (Tuttle 1995).

3. Sample geomorphic watershed work. The Division of Mines and Geology provided detailed geomorphic mapping for two of the watersheds used for the Pilot Monitoring Program work (Spittler 1995).

4. A summary report describing the Pilot Monitoring Program. Pilot Monitoring Program Manager Gaylon Lee of the SWRCB wrote a summary report and provided recommendations for the long-term program (Lee 1997).

- Hillslope monitoring data collection on 50 randomly selected THPs in Humboldt and Mendocino Counties in 1996. This was the first component of the long-term monitoring program and detailed field data were recorded on THPs that had over-wintered from 1 to 4 years. RPFs randomly selected 2 road segments, 2 skid trail segments, 2 landings, 2 watercourse crossings, and 2 watercourse and lake protection zones per THP. Information was recorded on problem locations as well as non-problem locations to allow the frequency of problems to be determined. Rule implementation was qualitatively rated, while Rule effectiveness data was quantitative (canopy, erosion

estimates).[1] For erosion features, the cause was determined as well as the location of sediment deposition and appropriate rule(s) implementation.

- Hillslope monitoring data collection from an additional 50 randomly selected THPs statewide in both 1997 and 1998. In addition to the information described above, data were also collected on large erosion events (>100 cubic yards on hillslopes, >10 cubic yards at failed crossings) when encountered anywhere within the THP.

- Hillslope data entry and evaluation. Data from the 150 THPs completed from 1996 through 1998 were entered into Version 2 of the Hillslope Monitoring Database. Frequency count queries were developed for the data and a detailed report documenting results from queries run on all 150 THPs was submitted to the BOF at the June 1999 meeting (BOF 1999).

- A pilot cooperative instream monitoring project. CDF contracted with the Mendocino County Resource Conservation District to complete a pilot watershed assessment and instream monitoring plan on the Garcia River watershed. These components were completed in 1998 (Euphrat et al. 1998) and the second phase to collect baseline data for the instream monitoring parameters described in the monitoring plan was conducted in 1998 and 1999. A final report will be written by Spring 2000. The project is attempting to use protocols compatible with those already being used by companies with ongoing instream monitoring programs so that the data will be comparable.

- An instream monitoring handbook. Under contract with CDF, DFG completed a handbook describing monitoring protocols for the primary instream monitoring parameters (DFG 1997).

[1] Note that evaluation of erosion control measures after one to four wet seasons is to be considered an initial determination of effectiveness. Long-term effectiveness can only be determined after a strong stressing storm event and several years of monitoring. This is particularly true for evaluation of impacts from mass wasting erosion features.

- Individual THP information. Beginning in 1995, CDF's audit foresters, focusing on completed plans in coho salmon watersheds, have documented canopy levels, numbers of large trees left in watercourse protection zones, and Class III watercourse protection measures. Data have been reported to the Board of Forestry and Fire Protection's Ecosystem Management Committee on a regular basis.

- Modified THP Completion Reports. CDF has redesigned its THP Completion Report (i.e., the document filed by CDF to indicate whether logging operations on a completed THP comply with the Forest Practice Rules) to provide quantitative data on canopy and qualitative information on implementation of the rules on all THPs. This procedure was field tested from 1997 to 1999 by CDF Forest Practice Inspectors throughout the State. Further refinements are expected to occur to ensure that the data collected will be meaningful and statistically valid. It is anticipated that the focus of the program will narrow to a few key parameters and use random sampling (i.e., only a certain percentage of THPs will be evaluated) in order to make the data more useful in accomplishing the program's objective. Specifically, data will be collected in two phases. Phase I evaluates implementation of Rule/THP requirements related to erosion control features on roads and construction of watercourse crossings for a randomly selected subset of the THP at the time the Completion Report is filled out, while Phase II evaluates the same area and features of the THP during the erosion control maintenance period after at least one over wintering. Additionally, during Phase I, WLPZ canopy and WLPZ width will be evaluated on a randomly selected 200-foot reach. The objective of Modified Completion Report monitoring is to use information collected during THP inspections to provide abundant data on the adequacy of the implementation and effectiveness of those forest practice rules specifically designed to protect water quality and riparian and aquatic habitat.

TRENDS

Evolving trends continue to challenge the MSG, CDF, and the BOF. In particular, the pressure to evaluate the effects of forest practices **at the watershed level** exceeds the ability of the existing monitoring program to provide information at this scale.

Hard questions are being asked by agency scientists, legislators, and the public about the impact of current timber operations on critical downstream beneficial uses of water. This is true for both publicly and privately owned forest lands. Unfortunately, in many cases scientific studies and data are not available to answer the types of questions that have been asked. As a result, management approaches that emphasize very restrictive practices until a watershed assessment process can be completed have been proposed and, in some places, adopted. These trends will continue and are exacerbated by a number factors, including:

- The listing and potential listing of numerous fish and wildlife species under the federal Endangered Species Act (ESA).

- The focus of the U.S. Environmental Protection Agency on the Clean Water Initiative to reduce non-point source pollutants (including sediment).

- The listing of numerous North Coast watersheds as impaired waterbodies under Section 303(d) of the Clean Water Act.

- The review of the management measures under the Coastal Zone Management Act.

- Landsliding and flooding following large storm events in the mid to late 1990's in California and the Pacific Northwest.

- The Pacific Lumber Company (PALCO) Habitat Conservation Plan/Sustained Yield Plan (HCP/SYP) interim prescriptions (prior to watershed analysis), which have raised expectations

and allowed stakeholders to request their application to harvesting conducted on other ownerships.

- The general findings of the Scientific Review Panel of the Watershed Protection and Restoration Council (SRP 1999). The panel reviewed the California Forest Practice Rules with regard to their adequacy for the protection of salmonid species.

- The context of demonstrating the effectiveness of current forest practices designed to protect beneficial uses in a watershed, including an adequate cumulative watershed effects analysis. Examples of heightened public concerns include the possibility of:

    1. Elevated peak flows resulting from the high rate of ongoing and proposed harvesting and road building.

    2. Elevated water temperatures resulting from reduction of overstory canopy cover in riparian zones.

    3. Reductions in current and future levels of large woody debris loading in class I, II, and III watercourses due to harvest of large conifers within riparian zones.

    4. Unacceptable increases in the amounts of both fine and coarse sediment loading in watercourses from hillslope erosion related to harvesting and road building.

    5. Elevated nutrient/toxin loading in watercourses related to harvesting and cultural practices utilized for successful conifer plantation establishment.

    6. The idea that opportunities for mitigation in some watersheds are limited or ineffective, therefore additional harvesting should be precluded.

KEY STRATEGIC ISSUES

Much greater emphasis has been placed on monitoring forestry impacts in the 1990s (MacDonald et al. 1991, MacDonald and Smart 1993, Wissmar 1993, Dissmeyer 1994)--and this likely will continue.

In California, monitoring the impacts of current forestry practices on water quality and anadromous fish habitat did not generally receive a high level of emphasis until the mid to late 1980s. Since then, numerous projects have been undertaken that provide relevant information. These include:

- Statewide studies on hillslope erosion associated with timber harvesting (Lewis and Rice 1989, Rice and Lewis 1990).

- Research projects, such as the Caspar Creek watershed study (Ziemer 1998, Lewis et al. 1998).

- A hillslope monitoring program developed by CDF and the Board of Forestry and Fire Protection (BOF 1999).

- Instream monitoring data collected by both private companies and public agencies, as well as data collected by watershed groups throughout the state.

- Development by timber companies of monitoring plan components of draft or approved Sustained Yield Plans, Habitat Conservation Plans, and other landscape level planning documents.

However, a number of factors suggest that it has been very difficult to bring this information to bear on forest policy decisions. These factors, when combined with the trends listed above, indicate several key issues that must be addressed by the long-term monitoring program:

- The questions, the focus, and/or the information requirements desired by federal, state, and local agencies, as well as stakeholders with an interest in water quality and listed species such as coho salmon, may be greater than is provided by the current long-term monitoring program.

- Implementation of the court-mandated agreement to fashion TMDLs is proceeding rapidly and may create monitoring strategies, designs, and priorities that are very different than the existing long-term monitoring program. For example, the focus for statistical validity may be the TMDL watershed rather than the State.

- There is currently no systematic, widely accepted program for completing watershed assessments on key watersheds in California, which makes it very difficult to relate conclusions about hillslope processes to instream impacts in a watershed context. (This may change in the next year.) Valid watershed assessments are necessary to ensure that both management activities and monitoring (particularly instream monitoring) activities are focused on the true limiting factors and stressors in a watershed. Such assessments are also critical in dealing with watersheds that have been 303(d) listed or support listed species.

- Large stressing storms (>5 year recurrence interval) are needed to test the effectiveness of mitigations in completed harvest plans, and storms of this magnitude have not occurred recently in many watersheds.

- Conclusions drawn about the impacts of timber operations conducted under the current forest practice rules are, for the most part, not based on statistically valid monitoring data. Instead, they stem more from perception and different ideas of acceptable risk to encourage watershed recovery.

- CDF does not enjoy public confidence in its regulatory efforts, so conclusions of the long-term monitoring program may be questioned.

- The impact of the PALCO HCP/SYP on the behavior of other landowners and other agencies is still unknown. Monitoring protocols, how they are carried out, how the information is used, and how the public perceives the information may determine what is acceptable for CDF and the MSG.

- Emphasis on watershed and fish habitat recovery efforts is substantial, but very diffuse and, to date, not coordinated between state and federal agencies. Monitoring programs and strategies that emerge may not be similar and may be inconsistent with the MSG's approaches.

- CDF Forest Practice Inspectors remain the largest potential monitoring resource for forest practices. However, the Modified Completion Report will generally not provide effectiveness data for strong stressing storms (>5 year recurrence interval). Thus, it needs to be clear that this program component will only complement the much more detailed implementation and effectiveness data that are collected with the Hillslope Monitoring Program.

SUGGESTED APPROACH

Through 1999, the MSG's monitoring program has largely consisted of hillslope monitoring data collected on 50 THPs randomly located throughout the state, a pilot cooperative instream monitoring project in a 303(d) listed watershed, and selected monitoring related projects. The long-term monitoring program envisioned in this Strategic Plan will be more robust--utilizing a somewhat broader combination of approaches to generate information on forest practice rule implementation and effectiveness related to water quality. The major components of the program will include: 1) continuation of the existing Hillslope Monitoring Program—evaluating 50 THPs per year, 2) incorporation of the Modified Completion Report process, 3) development of selected monitoring projects that can answer key questions regarding forest practice implementation and effectiveness, and 4) development of scientifically valid monitoring plans in 303(d) listed waterbodies, along with cooperative watershed monitoring projects in selected basins for long-term instream trend monitoring. Components 3 and 4 will be sufficiently flexible to respond to changing needs over time and available funding.

GOALS

The goals of this Strategic Plan derive from the Mission/Vision for the MSG--to provide timely information on the implementation and effectiveness of forest practices related to water quality that can be used by forest managers, agencies, and the public in California. Listed in order of highest priority to lowest, the goals are:

Goal #1: Continue the Hillslope Monitoring Program to test the implementation and effectiveness of forest practices used in THPs to protect water quality--including new rules, infrequently encountered Rules, and infrequent natural events--as well as to provide a sufficient sample size to evaluate non-standard practices.

Goal #2: Continue to implement and refine the long-term monitoring program, including integration of the Modified Completion Report into the program.

Goal #3: Develop a set of key monitoring questions that CDF/BOF/MSG believe are critical for understanding and assessing the impact of timber harvesting on beneficial uses of water. Projects will be designed to answer these specific questions regarding forest practice rule effectiveness, implementation, and/or assumptions.

Goal #4: Coordinate monitoring efforts associated with THPs and landscape level planning documents with timber companies, private landowners, governmental agencies, watershed groups, and others to produce scientifically valid monitoring plans for the 303(d) listed waterbodies. Encourage the development of cooperative watershed monitoring projects that include instream trend monitoring.

Goal #5: Provide timely information from finished and future field work to both federal and state agencies, foresters, watershed groups, local government, and the public; develop a public outreach program to ascertain key concerns and questions and to enhance public trust in the monitoring program

Goal #6: Develop information for training programs to reflect the results from finished and future field work.

Goal #7: Clarify the expectations of federal and state regulatory agencies about what questions must be answered regarding forest practices for water quality and fish habitat protection.

Goal #8: Coordinate with other state and federal agencies involved in resource protection on monitoring activities to avoid duplication of efforts, and to increase public confidence.

Goal #9: Provide early comment on the development of watershed assessment processes to assure that they are both scientifically credible and relevant to foresters, agencies, and the public (note that the MSG's role in watershed assessment implementation processes are yet to be defined). [Proper watershed assessment is necessary prior to implementing an instream monitoring program in a given watershed to ensure that monitoring activities are focussed on the true limiting factors.]

Goal #10: Keep informed of improvements suggested for cumulative watershed effects assessment and respond accordingly.

OBJECTIVES

The objectives of the Strategic Plan facilitate accomplishment of the individual goals by providing measurable targets.

Objectives for Goal #1: Continue the Hillslope Monitoring Program to test the implementation and effectiveness of forest practices used to protect water quality as part of THPs--including new rules, infrequently encountered Rules, and infrequent natural events--as well as to provide a sufficient sample size to evaluate non-standard practices.

1. Continue refinement and enhancement of the sampling design for hillslope monitoring to allow appropriate hypotheses to be developed and statistical analyses to be run on the data sets produced.

2. Continue monitoring in order to test infrequently encountered Forest Practice Rules and infrequent natural events.

3. Continue to monitor to provide a sufficient sample size to evaluate non-standard (i.e., in-lieu and alternative) practices.

4. Evaluate quality assurance/quality control (QA/QC) information and determine what additional work needs to be completed.

5. Complete a more in-depth analysis of the existing hillslope monitoring data set.

6. As new Forest Practice Rules are approved, evaluate them for implementation and effectiveness.

Objectives for Goal #2: Continue to implement and refine the long-term monitoring program, including integration of the Modified Completion Report into the program.

1. Determine if it would be possible to efficiently record the magnitude of storm events that have stressed each THP in the Hillslope Monitoring Program database (prior to resampling).

2. Implement a program to resample a certain percentage of Hillslope Monitoring Program THPs to monitor plans which had not been stressed by a strong stressing storm event (>5 year recurrence interval) during the overwintering periods prior to the first THP evaluation.

3. Each year, arrange funding and personnel for the collection of Hillslope Monitoring Program data based on existing protocols.

4. Develop the appropriate database, or modify an existing database, for data storage for the data collected as part of the Modified Completion Report work. Coordinate and train data entry personnel for this work.

5. Develop and implement QA/QC programs for the statewide Hillslope Monitoring Program and the Modified Completion Report Program.

6. Integrate the various components of the long-term monitoring program into an "Overall Monitoring Plan" that can link the various types of monitoring data (detailed hillslope measurements, qualitative ratings of rule implementation, instream data, etc.).

7. Review the large erosion event data collected as part of the Hillslope Monitoring Program and determine how to best utilize the data, including comparison of the mapped features to the geomorphic mapping completed for the Watershed Mapping Project by DMG in 1982/83.

Objectives for Goal #3: Develop a set of key monitoring questions that CDF/BOF/MSG believe are critical for understanding and assessing the impact of timber harvesting on beneficial uses of water. Projects will be designed to answer these specific questions regarding forest practice rule effectiveness, implementation, and/or assumptions.

1. Work with agencies represented on the MSG to define needed research questions and projects.

2. Use monitoring focused on testing key hypotheses, particularly those with a high degree of scientific uncertainty and a high risk of adverse impacts, to evaluate the effectiveness of specific practices (SRP 1999).

3. CDF Forest Practice monitoring staff and selected contractors will be responsible for monitoring project design, implementation, data collection and analysis, and interpretation of results.

4. Based on the design and implementation of monitoring plans for CDF's State Forests, including a Monitoring and Adaptive Management Plan for Jackson Demonstration State Forest's revised Management Plan, develop a set of water-quality related research projects on the State Forests.

Objectives for Goal #4: Coordinate monitoring efforts associated with THPs and landscape level planning documents with timber companies, private landowners, governmental agencies, watershed groups, and others to produce scientifically valid monitoring plans for the 303(d) listed waterbodies. Encourage the development of cooperative watershed monitoring projects that include instream trend monitoring.

1. Meet with the North Coast Regional Water Quality Control Board to clarify how state agencies can work together to produce both implementation and effectiveness monitoring plans for the TMDL drainages.

2. Coordinate and enhance monitoring and mitigation effectiveness review at a sample size sufficient to draw conclusions at the watershed level.

3. Develop a demonstration program to provide assistance to small, moderate, and large forest landowners in California in developing both instream and hillslope monitoring plans.

4. Monitor the implementation of monitoring programs developed as part of broad, landscape level planning documents, such as HCPs, SYPs, PTEIRs, etc., as well as post-completion mitigation monitoring included on THPs.

5. Develop a working relationship with the Forest Science Project located at Humboldt State University, Arcata, California and the Fish, Forests, and Farms Community Forum.

Objectives for Goal #5: Provide timely information from finished and future field work to federal and state agencies, foresters, watershed groups, local government, and the public; develop a public outreach program to ascertain key concerns and questions and to enhance public trust in the monitoring program.

1. Develop a Mass Mailing/CDF Memorandum to field foresters that describes the results of the Hillslope Monitoring Program to date and mail it by July 1, 1999 (completed).

2. Brief key State officials on monitoring results, including the Resources Secretary, the State EPA Secretary, and personnel from the State and various Regional Water Quality Control Boards.

3. Develop a directory and summary of existing watershed information and studies that MSG has utilized, and evaluate alternatives to make the information easily available, including the use of an electronic library over the Internet.

4. Develop a research note or guide to watershed groups that discusses the issue that data being collected is verifiable and can be used to draw valid conclusions on current condition and long-term trends in impaired watersheds.

5. Develop a research note that compares the conclusions on major impacts to water quality reported in Soil Erosion Studies Project summaries completed in the 1970's and early 1980's with those being found with current hillslope monitoring evaluations.

6. Based on Objectives #1 through 5, develop model presentations for CDF Forest Practice Inspectors and others to use throughout the State.

7. Produce annual or semi-annual reports for the BOF and CDF describing monitoring results, and place the documents on the CDF/BOF web site on the Internet.

8. In cooperation with the University of California College of Natural Resources, Division of Agriculture and Natural Resources, develop an ongoing program of outreach and contact through the Cooperative Extension Advisors and existing newsletters, such as *Forestland Steward*.

9. Develop a plan for coordinated periodic presentations and discussion sessions with watershed groups.

Objectives for Goal #6: Develop information for training programs to reflect the results from finished and future field work.

1. Facilitate the development of a new training program for equipment operators and potentially involve them in hillslope monitoring.

2. Develop training programs for both: 1) the contractors implementing the BOF/CDF statewide Hillslope Monitoring Program, and 2) CDF Forest Practice Inspectors conducting monitoring with the Modified Completion Report.

3. Work with DFG to incorporate the most recent monitoring results into updated versions of the Watershed Academy prepared for resource professionals.

Objective for Goal #7: Clarify the expectations of federal and state regulatory agencies about what questions must be answered regarding forest practices for water quality and fish habitat protection.

1. Meet with NMFS, U.S. EPA, the SWRCB, RWQCBs, and DFG to enhance communication regarding the parameters that they believe are important in a monitoring program for forest practices in California, and compare results to the existing long-term monitoring program.

Objectives for Goal #8*: *Coordinate with other state and federal agencies involved in resource protection on monitoring activities to avoid duplication of efforts, and to increase public confidence.

1. Request assistance for monitoring activities from DFG, DMG, RWQCBs, CALFED, and other state agencies involved in resource protection.

2. Utilize the “sister” agencies in conducting the Modified Completion Report monitoring procedures for forest practice rule implementation and effectiveness on THPs.

Objectives for Goal #9: Provide early comment on the development of watershed assessment processes to assure that they are both scientifically credible and relevant to foresters, agencies, and the public (note that MSG's role in watershed assessment implementation processes are yet to be defined). [Proper watershed assessment is necessary prior to implementing an instream monitoring program in a given watershed to ensure that monitoring activities are focussed on the true limiting factors.]

1. Offer a strong consulting role in watershed assessment development beginning immediately.

2. Be involved with implementation of the watershed assessment processes, as appropriate.

3. Provide ongoing guidance to CDF and the BOF on their role in watershed assessment.

Objectives for Goal #10: Keep informed of improvements suggested for cumulative watershed effects assessment and respond accordingly.

1. Review the CDF THP Task Force Report on Cumulative Impacts Analysis (1999).

2. Review the final report written by the University of California's Committee on the Scientific Basis for Evaluation of Cumulative Watershed Effects in Forested Landscapes.

3. Integrate new information on cumulative watershed effects into the long-term monitoring program as appropriate.

Appendix A. Contracted Monitoring Projects.

YEAR	CONTRACTOR	TOPIC	PRODUCTS
1991	Knopp-HSUF	Cold Water Fish Habitat Indices	Final Report for NCRWQCB and CDF
1991	Spittler-DMG	Erodible Watershed Index	Final Report for CDF; GIS layer + database
1991	Chakraborty	Domestic Water Supplies	Final Report for CDF; GIS layer + database
1991	Kier	Development of BMP Assessment Plan	Final Report for BOF/CDF—1993
1992	Lisle-USFS	V-star Tests in Varying Geology	Final Report for CDF—1993
1992	Trush-HSUF	Road Stream Crossings	Final Report on Crossings—1998
1992	Lee-SWRCB	PMP--Pilot Program Manager	Final Report for BOF/CDF—1997
1992	Erman-UCD	PMP—Independent Review	Final Report for BOF/CDF—1996
1992	Rae-DFG	PMP—Instream Component	Final Report for BOF/CDF—1995
1992	Chakraborty	Domestic Water Supplies-Amendment	(see above)
1993	Rae-DFG	PMP—Instream Component-2nd Year	(see above)
1993	Spittler-DMG	PMP—Geologic Component	Final Report for BOF/CDF; geologic maps
1993	Tuttle	PMP—Hillslope Component	Final Report for BOF/CDF; hillslope forms
1993	Kier	Fish Stocks at Risk	Final Report for DFG/CDF (Krieter Report)
1993	Trush-HSUF	Road Stream Crossings-2nd Year	(see above)
1993	Waters-HSUF	Pogue—Biological Indicators	HSU Masters Thesis
1993	Trush-HSUF	Stream Channel Studies-3 Grad Students	HSU Masters Theses or draft papers
1994	Trush-HSUF	Road Stream Crossings-3rd Year	(see above)
1994	Stacey-DFG	Watershed Academy	August 1995 Academy at HSU
1994	Hamby-HSUF	Watershed Academy	August 1995 Academy at HSU
1995	Schott-MCRCD	Hillslope Monitoring--1996	Data from 25 THPs in Mendocino Co.
1995	Ihle-HCRCD	Hillslope Monitoring--1996	Data from 25 THPs in Humboldt Co.
1995	Lewis/Baldwin-USFS	Statistical Review for Hillslope Monitoring	Final Report for CDF—1997
1995	Schott-MCRCD	Garcia River--Coop. Monitoring Watershed	Final Report--Instream Monitoring Plan—1998
1995	Rae-DFG	Instream Monitoring Handbook	Final Report—1997
1996	Poff and Associates	Hillslope Monitoring--1997	Data from 50 THPs
1996	Daus and Associates	QA/QC for Hillslope Monitoring 1997	Data from 10 THPs
1996	Schott-MCRCD	Garcia Coop. Monitoring Watershed-2nd yr	Work in progress for implementing 2nd phase
1996	Stacey-DFG	Watershed Academy--Amendment	May 1997 Academy in Santa Cruz
1996	Hamby-HSUF	Watershed Academy--Amendment	May 1997 Academy in Santa Cruz
1996	Warner-CSUS	Hillslope Monitoring Database Queries	Queries written for frequency counts
1997	Poff and Associates	Hillslope Monitoring--1998	Data from 50 THPs
1997	Schott-MCRCD	Garcia Coop. Monitoring Watershed-3rd yr	Work in progress for implementing 2Nd phase
1997	Warner-CSUS	Hillslope Monitoring Database--Amendment	Database improvements completed
1998	Poff and Associates	Hillslope Monitoring—1998—Amendment	Data entry, query development, report review
1998	Poff and Associates	Hillslope Monitoring—1999	Data from 50 THPs—work in progress
1998	Poff and Associates	Hillslope Monitoring—Class III monitoring procedures	Work in progress
1998	Warner-CSUS	Hillslope Monitoring Database—Amendment	Database improvements—work in progress

Appendix B. List of monitoring reports produced from 1991 through 1999--in chronological order.

Calif. State Board of Forestry. 1991. Recommendations for evaluating the effectiveness of the California Forest Practices Rules as the Best Management Practices (BMPs) for the protection of water quality. Prepared by the Best Management Practices Effectiveness Assessment Committee (BEAC), with assistance from William M. Kier Associates. Sacramento, CA. 29 p.

Calif. State Board of Forestry. 1993. Assessing the effectiveness of California's Forest Practice Rules in protecting water quality: recommendations for a pilot monitoring project and longer term assessment program. Prepared by the Monitoring Study Group (MSG) with assistance from William M. Kier Associates. Sacramento, CA. 55 p.

Knopp, C. 1993. Testing indices of cold water fish habitat. Unpubl. rept. submitted to CDF and the North Coast Regional Water Quality Control Board under Interagency Agreement No. 8CA16983. 56 p.

Lisle, T.E. 1993. The fraction of pool volume filled with fine sediment in northern California: relation to basin geology and sediment yield. Final Report submitted to the Calif. Dept. of Forestry and Fire Protection. 9 p.

McKittrick, M. 1994. Erosion potential in private forested watersheds of northern California: a GIS Model. Final report prepared for the Calif. Dept. of Forestry and Fire Protection. Sacramento, CA. 70 p.

Tuttle, A.E. 1995. Board of Forestry pilot monitoring program: hillslope component. Unpubl. Rept. submitted to CDF/BOF under Contract No. 9CA38120. 29 p. Appendix A and B: Hillslope Monitoring Instructions and Forms.

Rae, S.P. 1995. Board of Forestry pilot monitoring program: instream component. Unpubl. Rept. submitted to CDF under Interagency Agreement No. 8CA28103. Volume One. 49. p. Volume Two: Data Tables and Training Materials.

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